

CLAIMS

We claim:

1. A semiconductor die package, comprising:
a substrate having a first and a second
5 surface;
a die having a first surface and a second
surface, wherein the first surface of the die is
attached to the first surface of the substrate;
a heat spreader attached to the second
10 surface of the die; and
an encapsulant completely enclosing the die
and the heat spreader.
2. The die package of Claim 1, wherein the second
15 surface of the die is the face containing active
circuitry.
3. The die package of Claim 2, wherein the second
surface of the die is electrically coupled to the first
20 surface of the substrate.
-
- Sub 1
a1
4. The die package of Claim 3, further comprising
~~bond wires to couple the second surface of the die to~~
the first surface of the substrate.
-
- 25
5. The die package of Claim 1, further comprising
a conductive ball grid array coupled to the second
surface of the substrate.
-
- Sub 2
a2
- 30
6. The die package of Claim 1, further comprising
a thin layer of ~~thermal conductive adhesive~~ between the
die and the heat slug.
-

7. The die package of Claim 6, wherein the thin layer is of the order of approximately 1 mil or less.

5 8. The die package of Claim 1, wherein the encapsulant covering the uppermost portion of the heat slug is no more than 9 mils.

9. The die package of Claim 1, wherein the heat slug comprises:

an interior planar portion overlying and attached to the die;

an outer planar portion overlying and attached to at least a portion of the substrate;

15 and

a first angled portion extending from the outer planar portion towards the second surface of the die.

20 10. The die package of Claim 9, wherein the outer planar portion only overlies portions of the substrate in a direction extending laterally from the four sides of the die.

25 11. The die package of Claim 9, wherein the outer planar portion overlies substantially all of the outer portions of the substrate.

30 12. The die package of Claim 1, wherein the first surface of the die is the face containing active circuitry.

13. The die package of Claim 12, wherein the first surface of the die is electrically coupled to the first surface of the substrate.

5 14. The die package of Claim 13, further comprising an array of solder bumps to couple the first surface of the die to the first surface of the substrate.

10 15. The die package of Claim 9, wherein a thin layer of encapsulant is located between the outer planar portion of the heat slug and the first surface of the substrate.

15 16. A ball grid array (BGA) package, comprising:
 a substrate;
 a die coupled to the substrate;
 a thin thermal conductive adhesive layer on
 the die;
20 a heat slug attached to the die with the
 adhesive layer; and
 an encapsulant completely covering the heat
 slug.

25 17. The BGA package of Claim 16 wherein the encapsulant covering the uppermost portion of the heat slug is no more than 9 mils.

30 18. The BGA package of Claim 16, wherein the heat slug comprises:
 an interior planar portion overlying and
 attached to the die;

Sub
as
an outer planar portion overlying and
attached to at least a portion of the substrate;
and

5 a first angled portion extending from the
outer planar portion towards the upper surface of
the die.

19. The BGA package of Claim 18, wherein a thin
layer of encapsulant is located between the outer
10 planar portion of the heat slug and the upper surface
of the substrate.

20. A method of dissipating heat from a ball grid
array package, comprising:

Sub
as
15 attaching a die to a substrate;
attaching a heat slug directly to the die;
and
encapsulating the die and the heat spreader
completely.

20 21. The method of Claim 20, further comprising
leaving a thin layer of encapsulant over the upper most
portion of the heat slug.

25 22. The method of Claim 20, further comprising
forming a thin layer of encapsulant between the outer
portion of heat slug and the upper surface of the
substrate.

30 23. A method of packaging a semiconductor die,
comprising:
providing a substrate;

attaching a first surface of the die to the
substrate;

attaching a heat slug directly to a second
surface of the die, the second surface opposing
the first surface; and

5

completely covering the heat slug with an
encapsulant.

add
a₇

09923834.080701